

WHAT IS CLAIMED IS:

1. A microstrip antenna comprising:

an insulating substrate;

a plurality of antenna electrodes disposed upon one surface of said substrate,

each having a feed point for application of a high frequency signal;

a ground electrode disposed upon the other side of, or in the interior of, said substrate, for supplying ground level; and

a connection member for connecting at least one antenna electrode among said plurality of antenna electrodes to said ground electrode, at least at one spot thereof which is different from said feed point thereof;

wherein said connection member is disposed at a location within a plane region occupied by said at least one antenna electrode when said at least one antenna electrode is seen in plan view, such that the direction of the integrated radio wave beam which is emitted from said plurality of antenna electrodes is inclined from the direction normal to said substrate by connecting said at least one antenna electrode to said ground electrode at said location.

2. A microstrip antenna as described in Claim 1, characterized in that:

said at least one spot of said at least one antenna electrode which is connected to said ground electrode is located at a position differing from a position which is separated from said feed point of said at least one antenna electrode in a direction to its terminal edge by just a distance which is an odd number of times the quarter wavelength of said high frequency signal.

3. A microstrip antenna as described in Claim 1, characterized in that:

said connection member is an electrically conductive through hole which is pierced through at a spot of said substrate which corresponds to said at least one spot of said at least one antenna electrode, and has one end which is connected to said at least one spot of said at least one antenna electrode, and another end which is connected to said ground electrode.

4. A microstrip antenna as described in Claim 1 or Claim 2, characterized in that:

at least one edge of said at least one antenna electrode is disposed along at least one edge of said substrate; and
said connection member is an electric conductor which is arranged upon a side surface of said at least one edge of said substrate, and has one end which is connected to said at least one spot of said at least one edge of said at least one antenna electrode, and another end which is connected to said ground electrode.

5. A microstrip antenna as described in any one of Claims 1 through 4, characterized in that:

said at least one spot of said at least one antenna electrode which is connected to said ground electrode is in the vicinity of a terminal edge of said at least one antenna electrode, and is located at a position approximately in the middle thereof in a direction which is orthogonal to the direction from said feed point to its terminal edge.

6. A microstrip antenna as described in Claim 1, further comprising a switch which opens and closes the connection between said at least one antenna electrode and said ground electrode via said connection member.

7. A microstrip antenna as described in Claim 6, wherein said switch is disposed at a connection spot between said connection member

and said ground electrode.

8. A microstrip antenna as described in Claim 6, wherein said switch comprises two electrical contact points which are respectively connected to said connection member and to said ground electrode, and said two electrical contact points are arranged to be separated by a first gap between them in the ON state, and to be separated by a second gap which is larger than said first gap in the OFF state.

9. A microstrip antenna as described in Claim 6, wherein said switch comprises two electrical contact points which are respectively connected to said connection member and to said ground electrode, the mutual distance between said two electrical contact points is variable, and an insulating film is provided between said two electrical contact points.

10. A microstrip antenna as described in Claim 1, further comprising a feed line for supplying high frequency electrical power to said plurality of antenna electrodes, wherein said feed line is provided upon the other surface of said substrate, and is connected to said feed points of said plurality of antenna electrodes through electrically conductive through holes which are pierced through said substrate.

11. A microstrip antenna as described in Claim 1, characterized by further comprising a feed line for supplying high frequency electrical power to said plurality of antenna electrodes, wherein said feed line has a root feed point which is connected to an oscillator circuit and located at approximately the center of the substrate, and branches off in both mutually opposite directions from said root feed point, and wherein the direction of branching off of said feed line from said

root feed point, and the direction of excitation of each of the antenna electrodes, do not agree with one another in one direction.

12. A microstrip antenna as described in Claim 1, characterized in that:

said plurality of antenna electrodes upon the one surface of said substrate are covered by a dielectric body which has a relative permittivity which is larger than the relative permittivity of said substrate.

13. A microstrip antenna as described in Claim 1, characterized in that:

said at least one antenna electrode is divided into a plurality of stripe electrodes which extend in a direction from said feed point to a terminal edge.

14. A microstrip antenna comprising:

an insulating substrate;

at least one antenna electrode disposed upon one surface of said substrate,

having a feed point for application of a high frequency signal; a ground electrode disposed upon the other side of, or in the interior of, said substrate, for supplying ground level; and

a connection member for connecting said antenna electrode to said ground electrode, at least at one spot thereof which is different from said feed point thereof;

wherein said connection member is disposed at a location within a plane region occupied by said antenna electrode when said antenna electrode is seen in plan view, such that the direction of the integrated radio wave beam which is emitted from said antenna electrode is inclined from the direction normal to said substrate by connecting said antenna electrode to said ground electrode at said location.

15. A microstrip antenna as described in Claim 14, characterized in that:

said antenna electrode has a two dimensional configuration, so as to operate in a secondary resonant mode upon receipt of said high frequency signal.

16. A microstrip antenna as described in Claim 14, characterized in that:

said at least one spot of said antenna electrode which is connected to said ground electrode is located at a position differing from a position which is separated from said feed point of said antenna electrode in a direction to its terminal edge by just a distance which is an odd number of times the quarter wavelength of said high frequency signal.

17. A microstrip antenna as described in Claim 14, characterized in that:

said connection member is an electrically conductive through hole which is pierced through at a spot of said substrate which corresponds to said at least one spot of said antenna electrode, and has one end which is connected to said at least one spot of said antenna electrode, and another end which is connected to said ground electrode.

18. A microstrip antenna as described in Claim 14, characterized in that:

at least one edge of said antenna electrode is disposed along at least one edge of said substrate; and

said connection member is an electrically conductive body which is arranged upon a side surface of said at least one edge of said substrate,

and has one end which is connected to said at least one spot of

said at least one edge of said antenna electrode, and another end which is connected to said ground electrode.

19. A microstrip antenna as described in Claim 14, further comprising a switch which opens and closes the connection between said antenna electrode and said ground electrode via said connection member.

20. A microstrip antenna as described in Claim 19, wherein said switch is disposed at a connection spot between said connection member and said ground electrode.

21. A microstrip antenna as described in Claim 1, further comprising a dielectric body which is arranged so as to contact an end of said antenna electrode.

22. A microstrip antenna as described in Claim 1, further comprising a cavity structure arranged in the vicinity of said antenna electrode.

23. A microstrip antenna as described in Claim 1, further comprising a non-feed electrode arranged in the vicinity of said antenna electrode.

24. A microstrip antenna comprising:
 an insulating substrate;
 a plurality of antenna electrodes disposed upon one surface of said substrate, each having a feed point for application of a high frequency signal;
 a ground electrode disposed upon the other side of, or in the interior of, said substrate, for supplying ground level; and
 a plurality of connection members for connecting at least one antenna

electrode among said plurality of antenna electrodes respectively to said ground electrode, at a plurality of spots thereof which are different from said feed points thereof; and
a plurality of switches which respectively open and close the connections between said at least one antenna electrode and said ground electrode via said plurality of connection members.

25. A microstrip antenna comprising:

an insulating substrate;

at least one antenna electrode disposed upon one surface of said substrate, having a feed point for application of a high frequency signal;

a ground electrode disposed upon the other side of, or in the interior of, said substrate, for supplying ground level; and

a plurality of connection members for connecting said antenna electrode respectively to said ground electrode, at a plurality of spots thereof which are different from said feed point thereof; and

a plurality of switches which respectively open and close the connections between said antenna electrode and said ground electrode via said plurality of connection members.

26. A microstrip antenna comprising:

an insulating substrate;

a plurality of antenna electrodes disposed upon one surface of said substrate, each having a feed point for application of a high frequency signal;

a ground electrode disposed upon the other side of, or in the interior of, said substrate, for supplying ground level; and

a connection member for electrically coupling said at least one antenna electrode among said plurality of antenna electrodes to said ground electrode, at least at one spot thereof which is different from said feed point thereof; and

an impedance variable device which varies the impedance of the electrical coupling between said at least one antenna electrode and said ground electrode via said connection member for said high frequency signal.

27. A microstrip antenna as described in Claim 26, characterized in that:

said impedance variable device varies said impedance by varying the effective length or cross sectional area of an electric line between said at least one antenna electrode and said ground electrode via said connection member.

28. A microstrip antenna as described in Claim 26, characterized in that:

said impedance variable device varies the impedance by varying the capacitance between said at least one antenna electrode and said ground electrode via said connection member.

29. A microstrip antenna as described in Claim 26, characterized in that:

said impedance variable device is provided at a spot where said connection member and said ground electrode are electrically coupled.

30. A microstrip antenna as described in Claim 26, characterized in that:

a plurality of electrically conductive through holes which are pierced through said substrate are provided to said at least one antenna electrode as said connection member;

a plurality of said switches are provided to said plurality of through holes; and

said impedance variable device is arranged to select and turn ON any one of different combinations of the switches from among said

plurality of switches.

31. A microstrip antenna as described in Claim 26, wherein said impedance variable device comprises two electrical contact points which are respectively connected to said connection member and to said ground electrode, and said two electrical contact points are arranged to be separated by a first gap in a first state, and to be separated by a second gap which is larger than said first gap in a second state.

32. A microstrip antenna as described in Claim 26, wherein said impedance variable device comprises two electrical contact points which are respectively connected to said connection member and to said ground electrode, with the mutual distance being variable; and an insulating film which is provided between said two electrical contact points.

33. A microstrip antenna comprising:
an insulating substrate;
at least one antenna electrode disposed upon one surface of said substrate, having a feed point for application of a high frequency signal;
a ground electrode disposed upon the other side of, or in the interior of, said substrate, for supplying ground level;
a connection member for electrically coupling said antenna electrode to said ground electrode, at least at one spot thereof which is different from said feed point thereof; and
an impedance variable device which varies the impedance of the electrical coupling between said at least one antenna electrode and said ground electrode via said connection member for said high frequency signal.